

22. The method of claim 19, wherein the microalloy has a lead content of more than 350 weight ppm.

C4

REMARKS

Reconsideration of the above identified application, in view of the above amendments and the following remarks, is respectfully requested. The abstract has been amended to be a single paragraph as requested by the Examiner. Claim 9 has been amended to better define the invention. Support for this amendment is found at page 3, lines 26-33, of the specification. Claims 15-22 have been added. Support for claims 15-22 is found at original claims 1-4 and on pages 3, 6, and 8 (e.g., Table 1) of the specification. Claims 5-22 are pending and at issue.

The specification has been objected to under 37 C.F.R. §1.71 for failing to provide an adequate written description of the invention and an enabling disclosure. In particular, the Examiner asserts that it is unclear how the copper based microalloy of the present invention has an electrical conductivity greater than 101.5% IACS.

Claim 14 has been rejected under 35 U.S.C. §112, first paragraph, for lacking written description and enablement for the same reason as the specification.

Applicants respectfully traverse this objection and rejection and request reconsideration.

As shown in the attached article from the Internet (<http://www.connector.org/elect02.html>) (Exhibit A), IACS is the International

Annealed Copper Standard. The value of 100% represents the electrical conductivity of pure copper. The article also notes that commercially pure copper today has slightly better conductivity (101% IACS) than the original pure copper standard. Therefore, contrary to the Examiner's assertion, it is possible to have an electrical conductivity in a copper alloy greater than 101.5% IACS.

Accordingly, applicants respectfully request withdrawal of this objection and rejection.

Claims 9-14 have been rejected under 35 U.S.C. §112, second paragraph, as indefinite. Step (a) in claim 9 allegedly has two different ranges for S, Sb, Bi, Sn, Zn, Ni, Fe, and Ag. Contrary to the Examiner's assertion, only one range for each of these aforementioned elements is recited. The copper alloy can contain impurities of these elements in amounts of the order of tens of weight ppm (see step (a)(1)) but less than 80 weight ppm (see step (a)(2)).

It is also allegedly unclear as to what step has decreased the softening temperature, the annealing temperature, and the recrystallization temperature of the microalloy to values below 200° C.

Claim 9 has been amended to clarify that the heating step (c) yields the decrease in the half-softening temperature, annealing temperature, and recrystallization temperature to below 200° C of the copper microalloy. See page 3, lines 26-33, of the specification.

Claims 1-4 have been rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Japanese Patent Publication Nos. 10195562 (JP '562), 09078162 (JP '162), 62047443 (JP '443), and 61133351 (JP '351).

Claims 1-4 were canceled without prejudice in the Second Preliminary Amendment filed August 17, 2000.

JP '562, JP '162, JP '443, and JP '351 do not disclose or suggest alloys containing Zn, Fe, Ni, Sn, Ag, and Pb impurities as recited in the presently claimed invention. Therefore, the cited references do not anticipate or render obvious the presently claimed invention.

Accordingly, applicants respectfully request withdrawal of this rejection.

Claims 9-13 have been rejected under 35 U.S.C. §103(a) as obvious over JP '562, JP '162, JP '443, and JP '351. Although the cited references do not disclose preheating the copper alloy at 550-650° C for 5-600 seconds, the Examiner takes official notice that preheating certain "alloying ingredients before melting is a conventional step to reduce thermal shock and moisture of the ingredients." See paragraph 15 on page 4 of the September 24, 2001 Office Action. The Examiner concludes that it would have been obvious to one of ordinary skill in the art to preheat the alloy before casting in order to reduce thermal shock and moisture of the ingredients.

Pursuant to M.P.E.P. §2144.03, applicants request an affidavit from the Examiner regarding those facts to which he takes official notice.

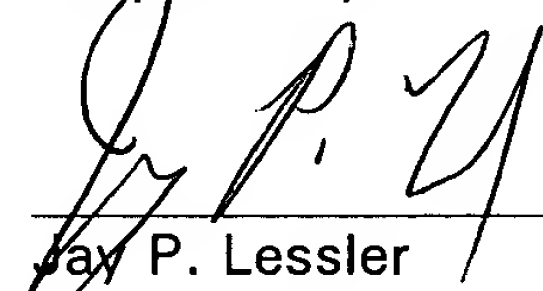
Applicants have amended claim 9 to clarify that the heating step occurs after casting. Therefore, the cited prior art does not disclose or suggest heating a cast microalloy at 550-650° C for 5-600 seconds as recited in the presently claimed invention. For the foregoing reason, the cited references do not render obvious the presently claimed invention.

Accordingly, applicants respectfully request withdrawal of this rejection.

Therefore, in view of the above amendments and remarks, it is respectfully requested that the application be reconsidered and that all pending claims be allowed and the case passed to issue.

If there are any other issues remaining which the Examiner believes could be resolved through either a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below.

Respectfully submitted,



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Marked-up Abstract and Claims
Accompanying February 25, 2002 Amendment

IN THE ABSTRACT:

The invention refers to batch casting, semi-continuous casting or continuous casting and rolling of copper, providing the addition of lead or refining the melt copper or the melt microalloyed copper to a lead content equal to or higher than 200 weight ppm. This minimizes the number of pores and defects, decreasing the number of incidences or breaks during casting and in service. However, it does not reduce the electrical conductivity. The addition of lead allows the cast and roll of copper microalloyed with elements such as S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag and Te, in concentrations of the order of tens of weight ppm. The copper microalloys manufactured in this way have annealing temperatures and strain strengths higher than those obtained from the equivalent tough-pitch copper or the equivalent microalloyed copper with lead content lower than 15-20 weight ppm.

[This patent also include a heat treatment at 550-650° C for 5-600s that, when applied to some compositions of the microalloys resulting of the related casting method gives similar values of annealing temperature, half-softening temperature, recrystallization temperature and strain-strength as tough-pitch copper. In addition, electrical conductivity is increased to 101.5%IACS or even higher.]

IN THE CLAIMS:

5. (Amended) A method for the manufacture of a copper microalloy comprising:

(a) mixing a copper alloy containing S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag or Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities; and

(b) casting the microalloy.

9. (Amended) A method for the manufacture of a copper microalloy containing lead, comprising:

(a) [preheating] mixing a copper alloy containing (1) S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag, or Te impurities in amounts of the order of tens of weight ppm and (2) less than 80 weight ppm of the impurities Zn, Ag, Cd, Sb, Ni, Fe, Bi, Sn and S, at 550-650° C with lead to yield a microalloy having at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities [for 5-600 seconds];

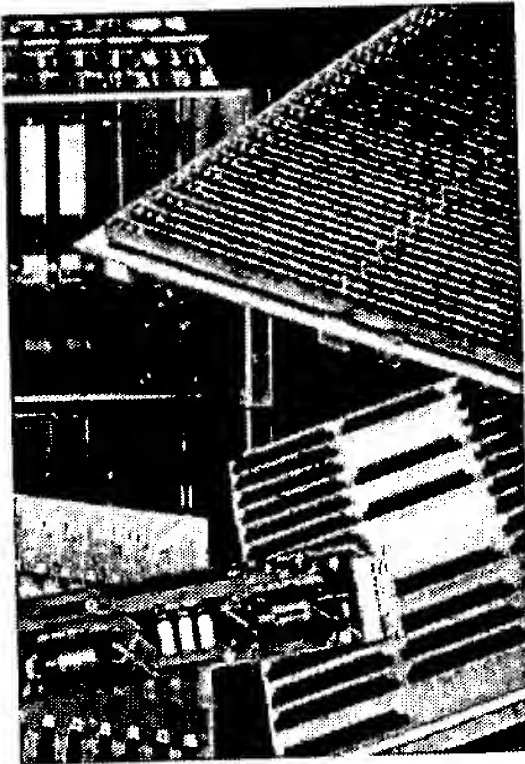
[(b) mixing the copper alloy with lead to yield a microalloy having at least 200 weight ppm of lead; and]

(b) [(c)] casting the microalloy from step (a); and

(c) heating the microalloy from step (b) at 550-650° C for 5-600 seconds [,] to decrease the softening temperature, the annealing temperature and the recrystallization temperature of the microalloy to values lower than 200°C.

ELECTRICAL AND THERMAL CONDUCTIVITY

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Electrical conductivity is the primary characteristic that distinguishes copper from other metals. Of the commercially useful metals, copper is only surpassed by silver. But copper alloys have a wide range of conductivity. There are hundreds of copper alloy strip metals from which to choose and some of them have conductivity as low as that of iron. Further complicating matters is that thermal and mechanical processing

variations can cause profound changes in conductivity. And metals with the highest strengths often have the lowest conductivity. Such alloys might be inappropriate for high current connector applications.

The conductivity of copper alloy strip metals is measured relative to a standard bar of "pure" copper that was long ago assigned a value of 100. Thus, when brass is said to have 28% IACS, it denotes an electrical conductivity 28% of that standard. ["IACS" is the International Annealed Copper Standard]. Due to improvements in metal refining techniques, commercially pure copper today has slightly better conductivity (101% IACS) than the standard.

The Unified Numbering System (UNS) doesn't directly classify copper alloys into groups of similar conductivity. But it does define "Coppers" as those that "...have a designated minimum copper content of 99.3% or higher". It further states that "High Copper Alloys" are "...alloys with ...less than 99.3% but more than 96% ...". The copper content is fundamental to conductivity in copper alloys. However, the different alloying elements added to copper have strikingly different effects on copper's conductivity. Silver, for example, causes no measurable effect whereas minute amounts of phosphorous can severely depress the conductivity.

The thermal conductivity is also an important parameter in connector design. Within alloy families, the thermal conductivity tends to be related to electrical conductivity. Alloys of higher electrical conductivity will tend to have higher thermal conductivity. This is convenient since thermal conductivity is rather difficult to measure, while electrical conductivity, or its inverse, electrical resistivity, is easy to measure.

Alloys of higher electrical resistivity(ρ) will waste more energy, since heat generated due to an electric current(I) is proportional to I^2 times the resistance. More important, the heat generated will raise the temperature of the connector, with potentially adverse consequences for the characteristics of the connector and its surroundings. Higher thermal conductivity alloys allow the designer to dissipate some of that heat, minimizing temperature rise. So high conductivity is generally a sought-after property of



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connector alloys.
